

## REMARKS

### I. Introduction

In response to the Office Action dated June 4, 2008, claims 1, 13, 37, 38, 39, 72, 73, 75 and 80 have been amended. Claims 1-9, 11, 13-44, 47, 49-73 and 75-80 remain in the application. Re-examination and re-consideration of the application, as amended, is requested.

### II. Claim Amendments

Applicants' attorney has made amendments to the claims as indicated above. These amendments are fully supported by the specification as filed and introduce no new matter. Specification support for methods and apparatuses that receive a plurality of input signals and then process the received input signals to form a system of linear equations can be found for example at page 47 paragraphs 2 and 3. Specification support for a program memory for carrying computer readable program code to cause a computer to execute procedure is described in the specification for example at page 39, paragraph 3.

### III. Claim Objections

In paragraph 3 of the Office Action, claims 13 and 49 were objected to as having improper dependencies. Applicants have amended claims 13 and 49 to overcome this rejection.

In paragraph 3 of the Office Action, the Examiner requested that claims 38 and 73 be written out in full for clarification purposes. Applicants have amended claims 38 and 73 accordingly.

### IV. Rejections Under 35 U.S.C. §112, First Paragraph

In paragraph 5 of the Office Action, claims 38 and 73 were rejected under 35 U.S.C. §112, first paragraph, as being indefinite because the claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Applicants have amended claims 38 and 73 to recite "~~An article of manufacture comprising a computer program storage device~~ program memory for carrying computer readable program code

to cause a computer to execute procedure. . . ”. As shown by the specification disclosure (e.g. page 39, paragraph 3), a program memory for carrying computer readable program code to cause a computer to execute procedure is described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

This amendment, with traverse and without acquiescence to the Examiner's rejections, renders these rejections moot.

V. Rejection Under 35 U.S.C. §101

In paragraph 7 of the Office Action, claims 1-9, 11, 13-44, 47, 49-73 and 75-80 were rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter.

All independent claims have been amended hereinabove to add additional steps (e.g. new steps (a) and (b) in claim 1) which clarify the patentable subject matter (i.e. the receipt of signals and their processing to form a system of linear equations etc.). In addition, all pending independent claims recite the step of providing an output of the result of the recited signal processing and analytical method for solving linear equations. In providing this output, the claimed method consequently recites the step of providing results of the analysis recited in the claims. As is known in the art, an output from an analysis of signals processed methodological steps that include a set of linear equations provides a concrete, useful and tangible result, i.e. the result identified by the Patent Office as being required to satisfy the requirements of 35 U.S.C. §101. For example, methodologies that employ linear equations to process signals occur frequently in many branches of science and engineering (see, e.g. page 1 lines 14 and 15). In this context, the specification provides a number of specific concrete, useful and tangible applications of the described methods in various branches of science and engineering (see e.g., the description beginning at 59 line 16).

Because the claims have been amended to clearly recite the concrete, useful and tangible result identified by the Patent Office as being required to satisfy the requirements of 35 U.S.C. §101, Applicants respectfully request a withdrawal of this rejection.

As noted above, Applicants' attorney has amended the claims as indicated above to overcome these rejections. However, should issues still remain in this regard, Applicants' attorney requests that the Examiner indicate how the rejection can be overcome, in accordance with the

directives of the Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility (Interim Guidelines) II. Specifically, should it be necessary, the Applicants' attorney requests that the Examiner identify features of the invention that would render the claimed subject matter statutory if recited in the claim. See Interim Guidelines IV.B.

#### VI. Prior Art Rejections

In paragraph 9 of the Office Action, claims 1-9, 11, 13-25, 30-44, 47, 49-61, 66-73 and 75-80 were rejected under 35 U.S.C. §102(b) as being anticipated by Simon, "An Overlaying Technique for Solving Linear Equations in Real-Time Computing," (Simon). In paragraph 10 of the Office Action, claims 27-29 and 63-65 were rejected under 35 U.S.C. §103(a) as being obvious in view of Simon.

Applicants respectfully traverse these rejections for the reasons articulated below.

#### A. REJECTIONS UNDER 35 U.S.C. §102(b)

In the outstanding rejection under 35 U.S.C. §102(b), the Patent Office asserts that the claimed subject matter is anticipated by the Simon disclosure, for example by disclosing a constellation of methodological elements that includes establishing in a processor a respective auxiliary value for each estimate value of an unknown variable. As discussed below, a detailed analysis of Simon shows that one of skill in the art would not agree with the Patent Office's interpretation of this disclosure. The skilled artisan would instead point out that because the Simon disclosure provides methods that focus on a different problem than that of the present invention, this disclosure fails to teach or suggest all of the elements recited in the claims as amended hereinabove. In particular, while both the Simon disclosure and the present application are both generally directed to subject matter relating to efficiently solving linear equations, the Simon disclosure teaches an iterative process to **solve smoothly varying sets of linear equations** starting from an initial estimate. In contrast, the invention recited in the pending claims is concerned with **solving a single system of linear equations**. As discussed below, because the Simon disclosure focuses on different problems in this field of technology, the Simon disclosure fails to teach or suggest the constellation of elements recited in Applicants' claims as amended hereinabove.

As disclosed in the specification, the inventor of the claimed invention has determined that by establishing a respective auxiliary value for each of a set of estimate values, and applying a

predetermined condition that involves the respective auxiliary value, the efficiency of the disclosed methods is optimized. Illustrating this, the independent claims as amended hereinabove recite apparatuses/methods for solving a system of  $N$  linear equations in  $N$  unknown variables, and explicitly include the steps of: (c) storing an estimate value for each unknown variable in a processor, (d) initialising in the processor each estimate value to a predetermined value and **establishing in the processor a respective auxiliary value for each estimate value**. For each estimate value, it is **determined whether a respective predetermined condition, which involves the respective auxiliary value, is satisfied**. These claims consequently recite subject matter wherein the estimate is updated in the processor if and only if the respective predetermined condition is satisfied. In the invention recited in the pending claims, the determining step is then repeated a plurality of times and the estimate values are subsequently output from the processor to provide an estimate of a solution to the system of linear equations.

The disclosure in Simon teaches a method for solving a continuous stream of linear equations with relatively close consecutive parameters (see, e.g. the abstract). For example, as noted by the Patent Office, Simon outlines in section III "General structure" including expression (9) and the paragraph below, two general approaches to approximating the inverse of a matrix, namely: (1) the Neumann series; and (2) and Newton's iterative method. The Simon disclosure explains that Newton's iterative method generally proceeds by selecting an initial approximation for the inverse of a matrix, and this approximation can be rapidly improved by successive iterations. While the Simon disclosure describes how to organize the interaction between two sets of linear equations, this disclosure does not describe in any detail how to solve a particular set of equations. As discussed in detail below, Simon consequently fails to teach or suggest the invention recite in the claims as amended hereinabove.

In the Simon disclosure, section III "Finding a Solution for a Set of Linear Equations", describes calculation of a solution vector  $x_{\text{next}}$  for a set of linear equations from a previous solution vector  $x_{\text{last}}$  from a previous set of linear equations. This disclosure teaches that, in order to start the process of solving a continuous stream of sets of linear equations, it is necessary to begin from initial equations to get the starting points for the iterative process. As the computational process develops subsequent values of  $A_{\text{new}}$  and  $b_{\text{new}}$  are supplied to the calculation from an external source. As shown for example by equation (17) in Simon, the matrix  $A_{\text{new}}$  and vector  $b_{\text{new}}$  correspond to the next set of

equations to be solved and the solution is based upon the previous calculated matrix inverse  $A_{old}^{-1}$ .

One of skill in this art would note that an analysis of the Simon disclosure shows that there is nothing in section III "General Structure" or "Finding a Solution for a Set of Linear Equations" that teaches or suggests **establishing in the processor a respective auxiliary value for each estimate value** (e.g. as recited in the pending claims). Instead, it is clear that no parameter disclosed in Simon teaches or suggests the "auxiliary values" recited in these claims. For example, neither the matrix  $A^{-1}$  or the vector  $x_{last}$  can teach or suggest the auxiliary values of the claim, not least because neither the matrix  $A^{-1}$  nor the vector  $x_{last}$  are used to determine whether a predetermined condition is satisfied, such that a particular estimate value is updated based upon the determination carried out using respective auxiliary value. In summary, while section III - "Finding a Solution for a Set of Linear Equations" teaches that, in order to begin the process of solving a stream of sets of linear equations, an initial set of equations must be initialised, there is nothing in Simon that discloses a respective auxiliary value for each initial value (i.e. as recited in Applicants claims).

In the outstanding Office Action, the Examiner specifically asserts that Simon, Figure 1 and "Preparing for the Next Cycle", teaches the feature of claim 1, where, for each estimate value, determining in the processor whether a respective predetermined condition, which involves the respective auxiliary value, is satisfied. Again, one of skill in the art would not agree with this interpretation of the Simon disclosure. In particular, Figure 1 of Simon shows a loop with a test to determine if the test condition  $\|x_{next} - x_{last}\|$  is small enough. As disclosed in Simon, this test condition involves the previous solution for a previous set of equations ( $x_{last}$ ) and the current solution for the current set of equations ( $x_{next}$ ). In this context, one of skill in this art would note that neither of these terms is a respective auxiliary value for each estimate value as both are approximate solutions to a particular set of linear equations. Moreover, neither of these terms correspond to a respective auxiliary value for an estimate value. As noted above, in Applicants' invention, the step of determining whether a **respective predetermined condition** is satisfied is carried out for each respective auxiliary value. In contrast, it is clear from a detailed analysis of Simon that the test condition  $\|x_{next} - x_{last}\|$  of Figure 1 is a determining based upon complete solution vectors. Consequently, this disclosure cannot teach or suggest determining for **each respective auxiliary value** as recited in the claims as amended hereinabove.

As noted for example in M.P.E.P. 2131, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. M.P.E.P. 2131 further states that in order to anticipate a claimed invention, a single art reference must show the identical invention in as complete detail as is contained in the claim and that “the elements must be arranged as required by the claim”. As noted above, the Simon disclosure fails to teach or suggest the claimed invention, one which includes for example the steps of: (c) storing an estimate value for each unknown variable in a processor, (d) initialising in the processor each estimate value to a predetermined value and establishing in the processor a respective auxiliary value for each estimate value. Because Simon fails to teach these elements as recited in Applicants’ claims, this disclosure cannot anticipate the claimed invention. For this reason, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. §102(b).

B. REJECTIONS UNDER 35 U.S.C. §103(a)

As noted in MPEP §2142 and 2143.03 for example, in order for the Patent Office to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. See, e.g. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). As noted above, the Simon disclosure fails to teach or suggest the claimed invention, one which includes the steps of: (c) storing an estimate value for each unknown variable in a processor, (d) initialising in the processor each estimate value to a predetermined value and establishing in the processor a respective auxiliary value for each estimate value. Consequently, the Simon disclosure cannot be relied upon to render obvious the invention recited in Applicants claims as amended hereinabove. For this reason, Applicants respectfully request a withdrawal of the rejection under 35 U.S.C. 103(a).

Thus, Applicants submit that independent claims 1, 37, 39, 72, 75 and 80 are allowable over Simon. Further, dependent claims 2-9, 11, 13-36, 38, 40-44, 47, 49-71, 73 and 76-79 are submitted to be allowable over Simon in the same manner, because they are dependent on independent claims 1, 37, 39, 72, 75 and 80, respectively, and thus contain all the limitations of the independent claims. In addition, dependent claims 2-9, 11, 13-36, 38, 40-44, 47, 49-71, 73 and 76-79 recite additional novel elements not shown by Simon.

VII. Conclusion

In view of the above, it is submitted that this application is now in good order for allowance and such allowance is respectfully solicited. Should the Examiner believe minor matters still remain that can be resolved in a telephone interview, the Examiner is urged to call Applicants' undersigned attorney.

Respectfully submitted,

GATES & COOPER LLP  
Attorneys for Applicant(s)

Howard Hughes Center  
6701 Center Drive West, Suite 1050  
Los Angeles, California 90045  
(310) 641-8797

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WJW/kmk

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By: William J. Wood/

Name: William J. Wood  
Reg. No.: 42,236